LAYER SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is the US National Stage of International Application No. PCT/EP2003/012095, filed October 30, 2003 and claims the benefit thereof. The International Application claims the benefits of European Patent application No. 02026012.1 EP filed November 21, 2002, both of the applications are incorporated by reference herein in their entirety.

FIELD OF THE INVENTION

[0002] The invention relates to a layer system in accordance with the preamble of the claims.

BACKGROUND OF THE INVENTION

[0003] US-A 5,952,110 discloses a layer system in which coarse particles are present in an outer layer. The coarse particles project out of the outer surface and serve to increase the abrasive resistance. The coarse particles have a different chemical composition than the layer.

[0004] US-A 5,579,534 discloses a layer system which includes at least three layers and in which coarse particles are arranged on a layer of finer particles.

[0005] US 6,444,331 shows a bonding layer which has been roughened in order to achieve improved bonding of thermal barrier coating and bonding layer.

[0006] However, layer systems still suffer from poor bonding of the layers to one another or of the layer to a substrate.

SUMMARY OF THE INVENTION

[0007] Therefore, it is an object of the invention to overcome this problem.

[0008] The object is achieved by a layer system in accordance with the claims.

[0009] Further advantageous configurations of the layer system are listed in the subclaims. The advantageous configurations of the subclaims can be combined with one another.

BRIEF DESCRIPTION OF THE DRAWING

[0010] The figure shows an exemplary embodiment of a layer system 1 according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] A layer system 1 comprises a substrate 4 which consists, for example, of a ceramic or metallic material, in particular of a cobalt- or nickel-based superalloy.

[0012] An intermediate layer 7 is arranged on the substrate 4. This intermediate layer in particular has a high density and, in the case of the superalloy as substrate 4, consists of the composition of type MCrAlY (M = Fe, Co, Ni).

[0013] The microstructure of the intermediate layer 7 at least partially has fine particles (fine grain size) or has been at least partially produced from particles of a fine grain size. The term fine grain size means grain diameters of less than 22 micrometers, in particular between 8 and 22 micrometers. The proportion of particles of a fine grain size used in the production of the intermediate layer 7 is, for example, 50%. In particular, the particles of a fine grain size allow the production of a dense intermediate layer 7.

[0014] The particles for the intermediate layer 7 have, for example, grain diameters of between 8 and 44 micrometers.

[0015] The intermediate layer 7 may have been produced in various ways: chemical vapor deposition (CVD), plasma spraying (APS, LPPS, VPS, etc.), high velocity oxyfuel

(HVOF) or other coating methods.

[0016] As far as possible a single layer of very coarse-grained spray material 10 has been applied to the outer surface 8 of the intermediate layer 7, the grain diameters being, for example, greater than 80 micrometers, in particular greater than 100 micrometers. This forms a studded surface.

[0017] In the case of plasma spraying, the plasma spraying installation is, for example, set in such a way that only a surface region of the coarse grains 10 melts in order to allow bonding of the coarse grains 10 to the intermediate layer 7. The coarse grains 10 have a composition, for example, of type MCrAlY.

[0018] It is also possible for the outer surface 8 of the intermediate layer 7 to be heated or melted, i.e. this surface is soft, so that when coarse particles 10 come into contact with it, in particular at a high velocity, these particles penetrate into the intermediate layer 7 and are anchored in place there.

[0019] It is also possible to enable coarse particles 10 to grow on the surface 8, for example by local growth, by growth nuclei being locally distributed over the surface 8 or by the surface being excited in such a way that growth conditions are only produced where the surface is excited.

[0020] The bonding surface 9 which is formed by the intermediate layer 7 and the coarse particles 10 is significantly larger than the outer layer of the still uncoated surface 8 of the intermediate layer 7.

[0021] Optionally, a further thin layer 13 (for example 40 to 80 micrometers thick) of a spray material of medium-coarse grains (mean grain size: 22 to 62 micrometers) is optionally applied using known methods to the structure of intermediate layer 7 and coarse particles 10 produced in this way.

[0022] The enlarged bonding surface 9 is retained. On account of the bonding surface 9, having an area which is preferably at least 20% greater, a better bonding strength of the outer layer 16 to the layer system 1 is achieved.

[0023] By way of example, the layer 13 has a composition of the type MCrAlY.

[0024] The coarse particles 10 and the medium particles 13 of the layer 13 can be applied by atmospheric plasma spraying (APS), low-pressure plasma spraying (LPPS), vacuum plasma spraying (VPS), cold gas spraying or spray compacting.

[0025] An outer layer 16 is applied to the layer 13.

[0026] The outer layer 16 is, for example, a ceramic layer, and when used for turbine components, in particular for gas turbine components, the outer layer 16 is a thermal barrier coating.